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MARSHALL, GERSTEIN & BORUN LLP
6300 SEARS TOWER
233 S. WACKER DRIVE
CHICAGO, IL 60606

EXAMINER	
KEBEDE, BROOK	

ART UNIT	PAPER NUMBER
2823	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/613,331	LEE ET AL.	
	Examiner	Art Unit	
	Brook Kebede	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☐ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,5-7 and 9-28* is/are rejected.

7)☒ Claim(s) *4,8 and 29-31* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *7/3/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The information disclosure statement filed on July 3, 2003 fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of each patent listed that is not in the English language. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Objections

3. Claims 1, 4, 8, 9, and 28-31 are objected to because of the following informalities:

Claim 1 recites the limitation "wherein the attack protection layer is electrically conductive and prevents a silicon substrate attack caused by **chlorine (Cl) gas**" in lines 2-4. However, there lack of antecedent basis for "chlorine (Cl) gas" because there is no base the chlorine gas in the preceding limitation. Appropriate correction is required.

Claim 4 recites the limitation "illuminating an ultra violet light having a higher energy than a binding energy of a SiCl reaction product on the surface of the Ti layer to remove the **remnant chlorine (C1) radical** in the Ti layer" in lines 2-5. However, there is lack of antecedent basis for "chlorine (C1) radical."

Claim 8 recites the limitation "deoxidizing the surface of the attack protection layer by using hydrogen (H_2) gas to remove the **remnant chlorine (Cl) radical** in the attack protection

layer after depositing the attack protection layer" in lines 2-6. . However, there is lack of antecedent basis for "chlorine (C1) radical" because there is no base the chlorine radical in the preceding limitation.

Claim 9 recites the limitation "illuminating an ultra violet light having a higher energy than a binding energy of SiCl on the surface of the attack protection layer to remove the remnant **chlorine (C1) radical** in the attack protection layer" in lines 2-6. . However, there is lack of antecedent basis for "chlorine (C1) radical" because there is no base the chlorine radical in the preceding limitation.In addition, change ";" to --.-- next to "layer" in line 6.

Claims 28-31 are also lack proper antecedent basis for "chlorine (C1) radical."

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 10 - 12 and 19 - 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 10 recites the limitation "The method as recited in claim 1, wherein a titanium nitride (TiN) layer formed by using a chemical vapor deposition (CVD) process is used for forming the attack protection layer" in lines 1-4.

As recited in claim 1 and further clarified in claim 2, the attack protection layer is poly-silicon layer. However, it is not clear that how the attack protection layer can be the TiN layer. In addition, recited in claim 1, Ti layer is deposited on the attack protection layer in order to form a silicon silicide layer. It is not clear how one of ordinary skill in the art will convent TiN layer to

titanium silicide layer by depositing Ti layer on it. For the above reasons the claim lacks clarity in its meaning and scope.

Claims 11 and 12 are also rejected as being dependent of the rejected base claim.

Claim 19 recites the limitation "The method as recited in claim 15, wherein a titanium nitride (TiN) layer formed by using a chemical vapor deposition (CVD) process is used as the attack protection layer" in lines 1-4.

As recited in claim 15 and further clarified in claim 29, the attack protection layer is poly-silicon layer. However, it is not clear that how the attack protection layer can be the TiN layer. In addition, recited in claim 15, Ti layer is deposited on the attack protection layer in order to form a silicon silicide layer. It is not clear how one of ordinary skill in the art will convent TiN layer to titanium silicide layer by deposting Ti layer on it. For the above reasons, the claim lacks clarity in its meaning and scope.

Claims 20 and 21 are also rejected as being dependent of the rejected base claim.

6. In light of the rejection 35 U.S.C. § 112 second Paragraph that set forth herein above, the following rejection is for claims 10 - 12 and 19 - 21 based on prior art which reads on the interpretation the claim language of the instant application as best as understood by the Examiner.

Applicants' cooperation is requested in reviewing the claims structure to ensure proper claim construction and to correct any subsequently discovered instances of claim language noncompliance. See *Morton International Inc.*, 28USPQ2d 1190, 1195 (CAFC, 1993).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1, 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu (US/6,087,235) in view of Sandhu et al. (US/5,173,327).

Re claim 1, Yu discloses a method of forming a semiconductor device having a metal silicide, comprising the steps of: forming a source/drain junction (306 308) area (see Fig. 7) on a silicon substrate (102); forming an attack protection layer (314 316) on the source/drain junction area (306 308), wherein the attack protection layer is electrically conductive (i.e., silicon layer) and prevents a silicon substrate attack caused by chlorine (Cl) gas (i.e., the silicon layer **314** and **316** can prevent chlorine layer form reaching the substrate portion of source **306** and drain **308** junctions as shown Fig. 9); and forming titanium silicide layer by diffusing titanium into the (see Figs. 13 and 14; Col. 7, lines 5-30) attack protection layer (i.e., silicidation performed to form a

titanium silicide layer **340** and **342** on the silicon layer **314** and **316** as depicted in Fig. 13) (see Figs. 7-14; Col. 5, line 3 – Col. 7, line 53).

However, Yu does not specifically disclose how the titanium layer that used to silicide the attack protection layer (silicon layer). In other word, Yu does not specifically disclose forming a titanium (Ti) layer over the attack a protection layer through a low pressure chemical vapor deposition (LPCVD) process using a source gas of $TiCl_4$.

Sandhu et al. Disclose method of depositing a titanium films for the semiconductor devices using the $TiCl_4$ precursor and H_2 precursors via low pressure CVD process (LPCVD) in order to form a uniform titanium layer on the wafer surface (see Abstract and Title; Col. 2, line 1 – Col. 4, line 12).

Both Yu and Sandhu et al. teachings are directed to depositing of a titanium (Ti) layer for fabricating of a semiconductor devices. Therefore, the teachings of Yu and Sandhu et al. are analogous. Hence, one of ordinary skill in the art would have been motivated to look to analogous art teaching LPCVD deposition of Ti film using a $TiCl_4$ precursor in order to deposit a uniform Ti film for semiconductor device fabrication as disclosed by Sandhu et al.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Yu reference with forming a titanium (Ti) layer over the attack a protection layer through a low pressure chemical vapor deposition (LPCVD) process using a source gas of $TiCl_4$ as taught by Sandhu et al. in order in order to deposit a uniform Ti film for semiconductor device fabrication.

Re claims 13 and 14, as applied to claim 1 above, Yu and Sandhu et al. in combination disclose all the claimed limitations including wherein the Ti layer is deposited by using the

LPCVD process at a temperature predetermined temperature range i.e., temperature 600 °C or greater (i.e., within the claimed temperature range of 600 °C to 700 °C) and predetermined and pressure range of 0.2 to 2 torr (i.e., within the overlap claim range of 1 torr to about 50 torr) and Ar gas carrier (See Sandhu et al. Col. 3, lines 13-65).

Furthermore, the claimed flow ration would been achieved within the level of ordinary skill in the art by routine optimization. One of ordinary skill in the art would have been motivated to optimize the ratio of NH_3 to Ar gas by optimizing the desired flow rate of particular gase by using routine experimentation in order to achieve the desired deposition rate of Ti layer.

Therefore, it would have been to one having ordinary skill in the art at the time of the invention is made to optimize the flow ratio of NH_3/Ar since it has been held where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990); and *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997). Furthermore, the specification contains no disclosure of either the critical nature of the claimed flow rate ratio or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919, f.2d 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

9. **Claims 2 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu (US/6,087,235) in view of Sandhu et al. (US/5,173,327) as applied in Paragraph 7 above, and further in view of Hong (US/5,843,826).**

Re claim 2 as applied to claim 1 in Paragraph 7 above, Yu and Sandhu et al. in combination disclose all the claimed limitation including forming of the attack protection layer **314 316** and that becomes silicide layer 340 and 342 in the source/drain contact area of the transistor (see Yu et al. Figs. 7-14; Col. 5, line 3 – Col. 7, line 53 and Sandhu et al. Col. 2, lines 50-51).

However, the combination of Yu and Sandhu et al. do not specifically disclose forming of the polysilicon layer using CVD process to use it as an attack protection layer. The difference between the teaching of instant application and the prior art (i.e., the combination of Yu and Sandhu et al. as applied in Paragraph 7 above) is that the prior art forms the crystalline silicon layer the can be used as chlorine protection layer using epitaxial growth whereas the instant application claimed invention forms a CVD polysilicon. In both cases, the process and the material is conventionally utilized to from raise source/drain junction.

Hong discloses forming a polysilicon layer 46 having a thickness of 500 angstroms (see Figs. 4-9) using LPCVD (low pressure CVD, i.e., a CVD process) in order to form an elevated (raised) source/drain junction (see Hong Col. 4, line 44 – Col. 5, line 34).

Yu, Sandhu et al. and Hong teachings are directed to forming a silicide layer for fabricating of a semiconductor devices. Therefore, the teachings of Yu, Sandhu et al. and Hong are analogous. Hence, one of ordinary skill in the art would have been motivated to look to

analogous art teaching of CVD deposited polysilicon layer in the source/drain junction area as taught by Hong in order to form an elevated source/drain contact.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Yu and Sandhu et al. reference with CVD polysilicon layer as taught by Hong et al. in order to form an elevated source/drain contact.

Furthermore, both the single crystalline silicon and polycrystalline silicon layers will provide similar raised (elevated) source drain contact and one of ordinary skill in that can use polysilicon instead of single crystalline silicon depending upon the suitability of known material. It would have been obvious to one of ordinary skill in the art at the time of the invention to use CVD polysilicon layer in the source/drain junction, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416 (CCPA 1960).

Re claim 6, as applied to claim 2 above, Yu, Sandhu et al. and Hong in combination disclose all the claimed limitations including forming the attack protection layer at predetermined thickness. In addition, the claimed thickness range can be achieved within the level of ordinary skill in the art by routine optimization.

Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that

the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). See also *In re Woodruff*, 919, f.2d 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

10. **Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu (US/6,087,235) in view of Sandhu et al. (US/5,173,327) as applied in Paragraph 7 above, and further in view of Komada (US/6,599,841).**

Re claim 3, as applied to claim 1 in Paragraph 7 above, Yu and Sandhu et al. in combination disclose all the claimed limitation including the limitation forming of the Ti layer using hydrogen (H_2) gas to remove a chlorine (Cl) radical in the Ti layer, (i.e., $TiCl_4 + 2H_2 \rightarrow Ti + 4HCl$) during the Ti layer formation process (See Sandhu et al. Col. 2, lines 50-51).

However, the combination of Yu and Sandhu et al. do not specifically disclose deoxidizing the surface of the Ti layer using H_2 gas to remove a remnant of Cl radical in the Ti layer (i.e., H2 gas treatment on the Ti layer after the Ti layer deposited).

Komada discloses deoxidizing the Ti surface by treating the Ti layer using H_2 gas in order to remove chlorine radical remain in the Ti layer (see Komada Col. 4, line 24 – Col. 5, line 47).

Yu, Sandhu et al. and Komada teachings are directed to depositing of a titanium (Ti) layer for fabricating of a semiconductor devices. Therefore, the teachings of Yu, Sandhu et al.

and Komada are analogous. Hence, one of ordinary skill in the art would have been motivated to look to analogous art teaching of H_2 gas treatment on the surface of Ti layer as disclose by Komada in order remove the remaining chlorine atom from theTi layer and to enhance the device performance.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Yu and Sandhu et al. reference with deoxidizing the Ti surface by treating the Ti layer using H_2 gas as taught by in order remove the remaining chlorine atom from theTi layer and to enhance the device performance.

11. **Claims 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu (US/6,087,235) in view of Sandhu et al. (US/5,173,327) as applied in Paragraph 7 above, and further in view of Shinriki et al. (US/6,063,703).**

Re claims 10 – 12, as applied to claim 1 in Paragraph 7 above, Yu and Sandhu et al. in combination disclose all the claimed limitation including the limitation forming of the Ti layer using hydrogen (H_2) gas to remove a chlorine (Cl) radical in the Ti layer, (i.e., $TiCl_4 + 2H_2 \rightarrow Ti + 4HCl$) during the Ti layer formation process (See Sandhu et al. Col. 2, lines 50-51).

However, the combination of Yu and Sandhu et al. do not specifically disclose forming TiN layer on Ti layer using a precursor $TiCl_4$ and a source NH_3 gas by CVD process.

Shinriki et al. disclose forming of TiN layer (15) over Ti layer (14) (see Fig. 1) via through CVD (i.e., LPCVD) process using $TiCl_4$ precursor and NH_3 gas (see Col. 3, lines 43-56). As Shinriki et al. disclose, TiN layer (15) deposited over Ti layer to serve as diffusion barrier layer.

Yu, Sandhu et al. and Shinriki et al. teachings are directed to forming a silicide layer for fabricating of a semiconductor devices. Therefore, the teachings of Yu, Sandhu et al. and Shinriki et al. are analogous. Hence, one of ordinary skill in the art would have been motivated to look to analogous art teaching of CVD deposited TiN layer using $TiCl_4$ and NH_3 precursor in order to form diffusion barrier layer TiN as disclosed by Shinriki et al.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Yu and Sandhu et al. reference disclose forming TiN layer on Ti layer using a precursor $TiCl_4$ and a source NH_3 gas by CVD process as taught by Shinriki et al. in order to form TiN diffusion barrier layer over Ti layer.

Furthermore, the claimed thickness range can be achieved within the level of ordinary skill in the art by routine optimization.

Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See *In re Aller*, 220 F.2d 454, 456, 105

USPQ 233, 235 (CCPA 1955). See also *In re Woodruff*, 919, f.2d 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

12. Claims 15, 19-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu (US/6,087,235) in view of Sandhu et al. (US/5,173,327), and further in view of Shinriki et al. (US/6,063,703).

Re claims 15 and 19-21, Yu discloses a method for forming a barrier metal layer for a semiconductor device fabrication, comprising the steps of: forming a contact hole (not labeled) exposing an active area through a selective etch of an insulation layer (354) formed on a silicon substrate (102) providing the active area (i.e., source/drain active area); forming an attack protection layer (314) for preventing the silicon substrate attack caused by a succeeding titanium layer deposition process on the active area exposed by the contact hole (see Fig. 14), wherein the attack protection layer is electrically conductive; forming a titanium (Ti) layer along a profile of the attack protection layer formed on the active area; diffusing the Ti layer into the attack protection layer to thereby forming a metal silicide layer (see Yu Figs. 7-14; Col. 5, line 3 – Col. 7, line 53).

However, the combination of Yu and Sandhu et al. do not specifically disclose forming TiN layer on Ti layer using a precursor $TiCl_4$ and a source NH_3 gas by CVD process.

Shinriki et al. disclose forming of TiN layer (15) over Ti layer (14) (see Fig. 1) via through CVD (i.e., LPCVD) process using $TiCl_4$ precursor and NH_3 gas (see Col. 3, lines 43-56). As Shinriki et al. disclose, TiN layer (15) deposited over Ti layer to serve as diffusion barrier layer.

Yu, Sandhu et al. and Shinriki et al. teachings are directed to forming a silicide layer for fabricating of a semiconductor devices. Therefore, the teachings of Yu, Sandhu et al. and Shinriki et al. are analogous. Hence, one of ordinary skill in the art would have been motivated to look to analogous art teaching of CVD deposited TiN layer using $TiCl_4$ and NH_3 precursor in order to form diffusion barrier layer TiN as disclosed by Shinriki et al.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Yu and Sandhu et al. reference disclose forming TiN layer on Ti layer using a precursor $TiCl_4$ and a source NH_3 gas by CVD process as taught by Shinriki et al. in order to form TiN diffusion barrier layer over Ti layer.

Furthermore, the claimed thickness range can be achieved within the level of ordinary skill in the art by routine optimization.

Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See *In re Aller*, 220 F.2d 454, 456, 105

USPQ 233, 235 (CCPA 1955). See also *In re Woodruff*, 919, f.2d 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

Re claims 22 and 23, as applied claim 15 above, Yu, Sandhu et al. and Shinriki et al. in combination disclose all the claimed limitation including forming of Ti layer using LPCVD process at predetermined pressure and temperature rage with Ar carrier gas with predetermined NH3/Ar ratio. Furthermore, the claimed the ratio of NH_3 to Ar gas, temperature and pressure range would been achieved within the level of ordinary skill in the art by routine optimization. One of ordinary skill in the art would have been motivated to optimize the flow ratio of NH_3 and Ar gas deposition, pressure and temperature range using routine experimentation in order to achieve the desired deposition rate and film thickness of Ti layer.

Therefore, it would have been to one having ordinary skill in the art at the time of the invention is made to optimize the deposition pressure and temperature rage since it has been held where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990); and *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997). Furthermore, the specification contains no disclosure of either the critical nature of the claimed flow rate ratio, temperature and pressure range or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another

variable recited in a claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919, f.2d 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

Re claims 24-27, as applied to claim 15 above, Yu, Sandhu et al. and Shinriki et al. in combination disclose all the claimed limitations including depositing of TiN layer by LPCVD at predetermined temperature and pressure and forming of titanium silicide layer by annealing at predetermined temperature.

Furthermore, the claimed the ratio of NH_3 to Ar gas, temperature and pressure range would been achieved within the level of ordinary skill in the art by routine optimization. One of ordinary skill in the art would have been motivated to optimize the flow ratio of NH_3 and Ar gas deposition, pressure and temperature range using routine experimentation in order to achieve the desired deposition rate and film thickness of Ti layer.

Therefore, it would have been to one having ordinary skill in the art at the time of the invention is made to optimize the deposition pressure and temperature rage since it has been held where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990); and *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997). Furthermore, the specification contains no disclosure of either the critical nature of the claimed flow rate ratio, temperature and pressure range or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another

variable recited in a claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919, f.2d 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

13. **Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Yu (US/6,087,235), Sandhu et al. (US/5,173,327) and Shinriki et al. (US/6,063,703), as applied in Paragraph 11 above, and further in view of Hong (US/5,843,826).**

Re claim 16 as applied to claim 15 in Paragraph 11 above, Yu, Sandhu et al. and Shinriki et al. in combination disclose all the claimed limitation including forming of the attack protection layer **314 316** and that becomes silicide layer 340 and 342 in the source/drain contact area of the transistor (see Yu et al. Figs. 7-14; Col. 5, line 3 – Col. 7, line 53 and Sandhu et al. Col. 2, lines 50-51).

However, the combination of Yu, Sandhu et al. and Shinriki et al. do not specifically disclose forming of the polysilicon layer using CVD process to use it as an attack protection layer. The difference between the teaching of instant application and the prior art (i.e., the combination of Yu, Sandhu et al. and Shinriki et al. applied in Paragraph 11 above) is that the prior art forms the crystalline silicon layer the can be used as chlorine protection layer using epitaxial growth whereas the instant application claimed invention forms a CVD polysilicon. In both cases, the process and the material is conventionally utilized to from raise source/drain junction.

Hong discloses forming a polysilicon layer 46 having a thickness of 500 angstroms (see Figs. 4-9) using LPCVD (low pressure CVD, i.e., a CVD process) in order to form an elevated (raised) source/drain junction (see Hong Col. 4, line 44 – Col. 5, line 34).

Yu, Sandhu et al. and Shinriki et al. and Hong teachings are directed to forming a silicide layer for fabricating of a semiconductor devices. Therefore, the teachings of Yu, Sandhu et al. and Shinriki et al. and Hong are analogous. Hence, one of ordinary skill in the art would have been motivated to look to analogous art teaching of CVD deposited polysilicon layer in the source/drain junction area as taught by Hong in order to form an elevated source/drain contact.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Yu, Sandhu et al. and Shinriki et al. reference with CVD polysilicon layer as taught by Hong in order to form an elevated source/drain contact.

Furthermore, both the single crystalline silicon and polycrystalline silicon layers will provide similar raised (elevated) source drain contact and one of ordinary skill in that can use polysilicon instead of single crystalline silicon depending upon the suitability of known material. It would have been obvious to one of ordinary skill in the art at the time of the invention to use CVD polysilicon layer in the source/drain junction, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416 (CCPA 1960).

14. **Claims 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable in combination of Yu (US/6,087,235), Sandhu et al. (US/5,173,327) and Hong (US/5,843,826), as applied to claim 2 in Paragraph 8 above, and in further view of Arst et al. (US/5,110,757).**

Re claim 5, as applied to claim 2 in Paragraph 8 above, Yu, Sandhu et al. and Hong disclose all the claimed limitation.

However, the combination do not disclose the source gas that utilized to from the LPCVD polysilicon layer.

Arst et al. disclose LPCVD process of forming a polysilicon layer utilizing the source gas selected form SiH_4, Si_2H_6 or SiH_2Cl_2 and carrier gas H_2 and HCl in order to deposit a polysilicon layer.

Yu, Sandhu et al., Hong and Arst et al. teachings are directed to fabricating MOSFET devices. Therefore, the teachings of Yu, Sandhu et al., Hong and Arst et al. are analogous. Hence, one of ordinary skill in the art would have been motivated to look to analogous art teaching of LPCVD deposited polysilicon using the source gas and carrier gases as disclosed Arst et al. in order to deposit uniform polysilicon layer.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Yu, Sandhu et al. and Hong reference with CVD using a gas composition selected form SiH_4, Si_2H_6 or SiH_2Cl_2 and carrier gas H_2 and HCl in as taught by Arst et al. in order to deposit uniform polysilicon layer.

Re claim 7, as applied to claim 5 above, Yu, Sandhu et al., Hong and Arst et al. in combination disclose all the clamed limitations.

Furthermore, the claimed the temperature and pressure range would been achieved within the level of ordinary skill in the art by routine optimization. One of ordinary skill in the art would have been motivated to optimize deposition pressure and temperature range using routine experimentation in order to achieve the desired deposition rate and film thickness of polysilicon layer.

Therefore, it would have been to one having ordinary skill in the art at the time of the invention is made to optimize the deposition pressure and temperature rage since it has been held where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990); and *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997). Furthermore, the specification contains no disclosure of either the critical nature of the claimed flow rate ratio, temperature and pressure range or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919, f.2d 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

15. **Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Yu (US/6,087,235), Sandhu et al. (US/5,173,327), Shinriki et al. (US/6,063,703) and Hong (US/5,843,826), as applied to claim 16 in Paragraph 12 above, and in further view of Arst et al. (US/5,110,757).**

Re claim 17, as applied to claim 16 in Paragraph 12 above, Yu, Sandhu et al. and Hong disclose all the claimed limitation.

However, the combination do not disclose the source gas that utilized to from the LPCVD polysilicon layer.

Arst et al. disclose LPCVD process of forming a polysilicon layer utilizing the source gas selected form SiH_4, Si_2H_6 or SiH_2Cl_2 and carrier gas H_2 and HCl in order to deposit a polysilicon layer.

Yu, Sandhu et al., Hong and Arst et al. teachings are directed to fabricating MOSFET devices. Therefore, the teachings of Yu, Sandhu et al., Hong and Arst et al. are analogous. Hence, one of ordinary skill in the art would have been motivated to look to analogous art teaching of LPCVD deposited polysilicon using the source gas and carrier gases as disclosed Arst et al. in order to deposit uniform polysilicon layer.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Yu, Sandhu et al. and Hong reference with CVD using a gas composition selected form SiH_4, Si_2H_6 or SiH_2Cl_2 and carrier gas H_2 and HCl in as taught by Arst et al. in order to deposit uniform polysilicon layer.

Re claim 18, as applied to claim 17 above, Yu, Sandhu et al., Hong and Arst et al. in combination disclose all the clamed limitations.

Furthermore, the claimed the temperature and pressure range would been achieved within the level of ordinary skill in the art by routine optimization. One of ordinary skill in the art would have been motivated to optimize deposition pressure and temperature range using routine experimentation in order to achieve the desired deposition rate and film thickness of polysilicon layer.

Therefore, it would have been to one having ordinary skill in the art at the time of the invention is made to optimize the deposition pressure and temperature rage since it has been held where the general conditions of a claim are disclosed in the prior art, it is not inventive to

discover the optimum or workable ranges by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990); and *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997). Furthermore, the specification contains no disclosure of either the critical nature of the claimed flow rate ratio, temperature and pressure range or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919, f.2d 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

16. **Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu (US/6,087,235) in view of Sandhu et al. (US/5,173,327) and Shinriki et al. (US/6,063,703), as applied in claim 15 in Paragraph 11 above, and further in view of Komada (US/6,599,841).**

Re claim 28, as applied to claim 15 in Paragraph 11 above, Yu and Sandhu et al. in combination disclose all the claimed limitation including the limitation forming of the Ti layer using hydrogen (H_2) gas to remove a chlorine (Cl) radical in the Ti layer, (i.e., $TiCl_4 + 2H_2 \rightarrow Ti + 4HCl$) during the Ti layer formation process (See Sandhu et al. Col. 2, lines 50-51).

However, the combination of Yu and Sandhu et al. do not specifically disclose deoxidizing the surface of the Ti layer using H_2 gas to remove a remnant of Cl radical in the Ti layer (i.e., H2 gas treatment on the Ti layer after the Ti layer deposited).

Komada discloses deoxidizing the Ti surface by treating the Ti layer using H_2 gas in order to remove chlorine radical remain in the Ti layer (see Komada Col. 4, line 24 – Col. 5, line 47).

Yu, Sandhu et al. and Komada teachings are directed to depositing of a titanium (Ti) layer for fabricating of a semiconductor devices. Therefore, the teachings of Yu, Sandhu et al. and Komada are analogous. Hence, one of ordinary skill in the art would have been motivated to look to analogous art teaching of H_2 gas treatment on the surface of Ti layer as disclose by Komada in order remove the remaining chlorine atom from the Ti layer and to enhance the device performance.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Yu and Sandhu et al. reference with deoxidizing the Ti surface by treating the Ti layer using H_2 gas as taught by in order remove the remaining chlorine atom from the Ti layer and to enhance the device performance.

Allowable Subject Matter

17. Claims 4, 8, 9, 29, 30 and 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

18. Claim 9 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure Moslehi (US/5,168,072) disclose similar inventive subject matter.

Correspondence

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brook Kebede whose telephone number is (571) 272-1862. The examiner can normally be reached on 8-5 Monday to Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (571) 272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Brook Kebede
Examiner
Art Unit 2823

Brook Kebede

BK
February 21, 2005